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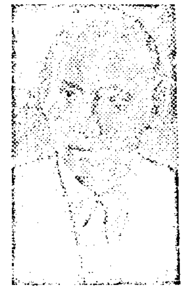
Science And Man—

DDT: Boon Or Bane?



By JOSHUA LEDERBERG

The Nobel Prize in medicine for 1948 was awarded to the Swiss chemist Paul H. Mueller for his discovery of the remarkable new insecticide dichloro-diphenyl - trichloromethylmethane, or DDT.

Few scientific discoveries have been applied so quickly for large-scale humanitarian benefit as DDT, whose insecticidal potency was first reported in 1940.

The Nobel Prize citation recounted that in October of 1943, a heavy outbreak of typhus occurred in Naples. When customary relief measures prove dinadequate, DDT treatment was introduced (for theh eradication of typhus-bearing lice). In January, 1944, 1.3 million people were treated, the citation noted, "and in a period of three weeks the typhus epidemic was completely mastered. Thus for the first time in history a typhus outbreak was brought under control in winter."

After World War II, DDT was deployed worldwide as one of the main weapons against malarial mosquitos and many other disease-bearing insects. It has unquestionably saved many millions of human lives and brought many more out of the deadly lethargy of chronic pestilence. DDT has also played a vital part in the protection of food crops against insect attack.

At the occasion of his prize award, Dr. Mueller took pains to point out that we did not sufficiently understand the biological action of DDT on insects, and by implication the scope of potential side effects on other species of animals and on man. Two decades later, we still suffer from having only a fragmentary understanding of its basic effects on cells. But we are beginning to realize that DDT is a two-edged sword whose long-term dangers may even rival its unarguable human benefits during and since World War II.

DDT has a remarkable capacity to persist in the environment, its residues passing from soil to insects to birds and fish and the animals that eat them. The chemical's persistence is a positive advantage in crude public health work — a few applications a year can hold down the mosquito production of a malarial swamp. But DDT has been accumulating in the terrestrial environment to the point that significant traces can be found in Antarctic birds, thousands of miles away from the original sources of application. DDT can be called the first qualitatively new compound to be spread throughout the world by human activity.

In some wild species of birds, DDT has accumulated in body tissues to the point of causing serious disturbances in the metabolism of sex hormones. These are manifested by a serious thinning of the calcium carbonate shells of the birds' eggs and interference in breeding. Many biologists now warn that several species of birds of prey, notably the preegrine falcon, are in danger of early extinction.

Man comes first, we may say, but we must at least perceive the lesson of how we may be fouling our own nest. The falcon may be doomed, and we may not be able to afford to give up DDT for its more crucial life-preserving applications. At the very least, we have to redouble our efforts to investigate what is in store for our own species in an environment of which DDT is now an established component.

DDT is only one of many drugs that cause changes in the metabolic capability of the liver. These changes are relatively nonspecific, and the rapid destruction of steroid hormones appears to be a coincidental byproduct of the liver cells' adaptation to DDT. The individual exposed to DDT can therefore be expected to show a changed reaction to a number of other chemicals and drugs, even under conditions where the DDT alone shows little toxic effects. The long-term effects of such combinations are poorly understood.

These effects are closely bound up with the deepest questions of the functioning of DNA and RNA in the synthesis of proteins. Appropriate research is making a fitful start today. We can find no more striking example of the unmistakable relevance of molecular biology for global survival.